SEX OF THERAPIST AND SEX OF SUBJECT: PSYCHOPHYSIOLOGICAL RESPONSES TO AUDIO RECORDED PROGRESSIVE RELAXATION TRAINING

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by

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ABSTRACT

Psychophysiological responses of sixteen male and sixteen female subjects were monitored during exposure to two relaxation tapes. One tape used a female voice and the other a male voice. Four experimental groups were used to balance for experimenter-subject sex differences. Results showed that during the relaxation tapes all groups showed decreases in psychophysiological reactivity. The sex of the voice on the tapes was not a significant factor in the psychophysiological reactivity of the subjects. In a contrast between male and female subjects, females showed significantly lower peripheral skin temperature and lower skin conductance levels. No significant differences were found between male and female subjects over time. The implications of the findings are discussed.

CHAPTER 1

INTRODUCTION

The use of relaxation has an extensive history in medicine, clinical psychology and psychiatry. The pioneering work of Edmund Jacobson (1929) was concerned principally with the exploration of the Watsonian notion that thoughts and feelings were located in the peripheral musculature. Jacobson, a physician, also reported therapeutic benefits derived from relaxation when it was practiced by anxious people.

The use of psychophysiological measures in the investigation of the physiological effects of relaxation has produced conflicting results. Because of this it is difficult to summarise the available knowledge concerning the effects of brief relaxation training, and the contradictions in the results suggest that the operation of at least some of the factors is not yet fully understood.

Historically, physiological events have been difficult to measure and the resulting measures have often been affected by errors in the measurement system. Because the validity of inferences drawn from these measures is affected by the source and degree of error, understanding and minimization of error are crucial. Technology is continually being developed and refined to facilitate accurate recording of physiological events. Because many physiological events can now be observed more accurately, it is possible to assess individual differences between groups or 'classes' of individuals and assess change in physiological events over time in response to specific stimuli and to intervention procedures.

The gender of the subject has been shown (Shmovonian, Miller and Cohen, 1968; Kopaz and Smith, 1971; Epstien, Boudreau and King, 1975; Schwartz and Logue, 1977) to affect the psychophysiological reactivity to a specific stimuli or intervention procedure. However, it is a variable that is frequently ignored in research utilising psychophysiological reactivity as a measurement of outcome.

The purpose of this study was to investigate individual differences between males and females in psychophysiological responding to relaxation instructions and also to explore possible interactions between gender of experimenter and gender of subject in response to relaxation instructions using psychophysiological responses.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1 SCOPE OF THIS REVIEW

Differences between males and females, as an independent variable in research, is an area in which there is increasing interest in many areas of psychology. It is not within the scope of this review to cover all research studies which have noted gender as an independent variable, since often these studies have included it as an adjunct to the major line of research. This review will cover the research using psychophysiological measures in progressive relaxation training. Then the relevant research on therapist-subject sex differences will be discussed. Finally each psychophysiological measure used will be discussed in relation to gender differences.

2.2 PROGRESSIVE RELAXATION TRAINING

The psychophysiological effects of relaxation were first explored by Jacobson in the 1930's. Using an extremely lengthy training in muscular relaxation Jacobson (1934) found decreases of muscular activity in trained patients but not in untrained controls. In two further studies (1939, 1940) both blood pressure and heart rate were found to drop during training sessions. Unfortunately Jacobson's results are of little scientific value due to his neglect of statistical procedures and appropriate control groups (Mathews, 1971).

Progressive relaxation training played an important role in the development of systematic desensitization (Wolpe, 1958). It is not within the scope of this review to discuss the use of systematic desensitization as a treatment of maladaptive anxiety. However, as a result of Wolpe's work, research on relaxation has generally focused on it as a component of the desensitization paradigm (Miller and Bernstein, 1977) and its role will be briefly outlined.

The principle of systematic desensitization, Wolpe termed the reciprocal inhibition principle. According to this principle the ability of a given stimulus to evoke anxiety is weakened if

> "A response antagonistic to anxiety can be made to occur in the presence of an anxiety evoking stimuli so that it is accompanied by complete or partial suppression of the anxiety."
> (Wolpe, 1958, p. 171)

The antagonistic response to anxiety that Wolpe used was progressive relaxation based on Jacobson's work.

Despite extensive research, the facilitative role of muscular relaxation in the systematic desensitization process is still unresolved (Barabasz, 1977; O'Brien and Borkoveč, 1977). However, the majority of desensitization research has ignored the physiological response component and its measurement despite Wolpe's (1958) autonomic definition of anxiety.

Relaxation training has also received attention as a technique in its own right either on its own or in conjunction with other treatments (Bernstein and Borkovec, 1973; Goldfried and Davison, 1975). Relaxation training has been used to treat a wide variety of behaviour disorders, including tension headaches

(Epstien, Hersen and Hamphill, 1974), test anxiety (Russell and Sipich, 1974), insomnia (Graham, Wright, Tomen and Mark, 1975; Borkovec and Fowles, 1973; Nicassio and Bootzin, 1974), hypertension (Jacob, Kraemer and Agras, 1977) and treatment of self-injurous behaviour in retardates (Steen and Zuriff, 1977).

Relaxation training is typically a much abbreviated version of the Jacobson technique. The major goal of relaxation training is to reduce physiological arousal and produce at least neutral, preferably positive, affect. Since the autonomic and cortical activity to be reduced is not under direct voluntary control, relaxation training usually focuses on the skeletal muscles and respiration, which are partially under direct voluntary control. The client is usually asked to recline on a cough or recliner chair that provides complete physical support. The therapist instructs the client to systematically tense and hold small muscle groups, a hand and forearm, for example, and then releases them; some degree of relaxation or reduction of tonic muscle tension is produced during the release. By repeating this tension-release cycle several times systematically with all muscle groups in the body and holding a deep breath concurrently with tension and releasing it for normal breathing at the same time, he/she releases muscle tension. The client can usually produce a state of reduced physiological arousal with no detectable tension at all in one to six training sessions.

The first controlled study of brief muscular relaxation as used in desensitization was carried out by Grossberg (1965).

Thirty male students were divided into three groups, one of which received recorded instructions in relaxation for two 40 minute periods, approximately 5 days apart, while one control group filled in the same time by listening to self-selected relaxing music, and the other attempted self-relaxation without further instructions. Electromyograms from the forehead and forearm were recorded throughout, as was skin resistance and heart rate. No differences in general level were found among the groups in any of the measures used, indicating that the relaxation training procedure did not have any marked physiological effect.

Paul (1969) investigated sixty female students who were divided into three groups according to whether they received training in muscular relaxation, hypnotic relaxation or attempted self-relaxation without instruction. Electromyograms from the forearm, heart rate, respiration rate and skin resistance were measured continuously through the two half hour sessions. Compared with the self-relaxation group, the group training in muscular relaxation was found to have a significantly greater decrease of physiological activity over the session in all measures except skin resistance where no significant differences were obtained and the trend of the results was in the opposite direction.

Edelman (1970) investigated the effects of progressive relaxation on blood pressure and heart rate. Using fourty male undergraduate students he compared progressive relaxation and its autonomic effects with three control groups. The progressive relaxation group was not statistically differentiated from the control groups although all procedures brought about decreased systolic blood pressure. Edelman (1970) concluded that these results cast doubt upon contentions that the progressive relaxation exerts any unique effect on autonomic function.

Lehrer (1970) studied the effect of muscular relaxation on habituation of the skin potential response elicited by electric shock, using four groups, one instructed to relax, one to increase muscular tension, one to maintain a moderate level of muscular tension and a group receiving no instructions. The relaxation group habituated to shock significantly more quickly than either the increased tension or sustained tension groups. There was no difference, however, between the group receiving relaxation instructions and the group receiving no instructions.

As the mechanics of relaxation are so straightforward, in the clinical situation they are often taped for home practice (Goldfried and Davison, 1976). Taped relaxation instructions are also used in research in order to control for differences in administering the relaxation instructions.

The comparative effectiveness of live versus taped relaxation instructions have been investigated. Paul and Trimble (1970) evaluated relaxation training and hypnotically suggested relaxation by means of prerecorded tapes, against the same procedures conducted in the usual live manner, regarding effectiveness for reducing subjective tension and physiological arousal. Three groups of ten undergraduate female subjects participated individually for two sessions one week apart, receiving a) abbreviated progressive relaxation instructions via recorded tape without experimenter's presence, b) hypnotic instruction via recorded tape without experimenter's presence, or c) self-relaxation control. The results showed that in general neither hypnotically suggested relaxation nor the control were effected by mode of presentation. Recorded relaxation, however, was inferior to the live procedure. The authors concluded that this was a result of a loss of response-contingent progression.

Israel and Beimen (1977) compared the effects of live and taped progressive relaxation and self-relaxation using measures of physiological arousal and subjective tension. Fourteen males and eleven females were selected from respondents to newspaper advertisements that solicited tense people to participate in a therapy study. No difference was noted between the two groups on measures of physiological arousal. However there was a greater reduction of subjective tension with live relaxation training.

The findings of Israel and Beimen (1977) are inconsistant with Paul and Trimble (1970). Israel and Beimen (1977) suggest that this may be due to differences in the nature of the subject population, Paul and Trimble (1970) using an unselected, non-volunteer female college student group, while they used male and female respondents to an advertisement for therapy or an analogue clinical population.

2.3 THERAPIST-SUBJECT SEX DIFFERENCES

The complexities of sex differences in the social context of the psychological experiment have been reviewed by Rosenthal (1966). Rosenthal (1969) raised the question as to whether sex differences that emerge from psychological experiments are due to the subject's genes, morphology, enculturation or simply to the fact that the experimenter treated the male and female subjects differently so that, in a sense they were not the same experiment at all. Though the sex of the experimenter does not always affect the performance of the subject in a great many cases it does (Rosenthal, 1969).

Recently the question of sex differences in the therapeutic setting has become a topic for study (Chesler, 1971). Sex pairings may effect the counseling process. Howard, Olinsky and Hill (1970) discovered that following therapy, female clients were more satisfied with female therapists. Chesler (1971) hypothesized that all male pairings would encourage aggression and competition, whereas male therapist-female client pairings would involve the greatest discussion of sexual matters with little regard for the women's identity. Carter (1971) suggested that female counselors are better equipped as counselors because they have been raised to be understanding and nurturant. Hill (1975) found that clients of female counselors reported more satisfaction with their sessions that did clients of male counselors.

Cotler (1970) noted that in the majority of desensitization studies conducted with a college population, the subjects have been female and the therapists male. In one study where therapist-client sex differences were treated as an independent variable (Robinson and Suinn, 1969) significant sex differences were found on one self-rating measure (Specific Fear Rating) but not on another (General Fear Inventory). Robinson and Suinn (1969) suggested that because the female subject may have been able to relax more and/or tried harder to please their same sex therapist, the self-rating measure may be less accurate than the behavioural measure.

Cotler (1970) studied the effects of therapist and patient sex differences on treatment outcome using automated desensitization. Sixteen male and sixteen female snake-anxious college students were selected for treatment. Four treatment groups were used in order to balance for therapist-client sex differences. Subjects were given modified Fear Survey Schedules and a behavioural test prior to treatment, after treatment and a few weeks following treatment. Cotler (1970) concluded that sex differences between client and therapists were not a critical factor in treatment outcome.

Unfortunately Cotler (1970) used no psychophysiological measures in assessing the effects of sex differences between client and therapist. There do not appear to have been any published studies on the effects of therapist-subject sex differences on psychophysiological measures.

2.4 PSYCHOPHYSIOLOGICAL MEASURES

As a distinct discipline psychophysiology is a relatively young science. Only since the beginning of the technical revolution has the psychophysiologist had the instrumentation to develop ideas and theories into more scientific models. However, much technical knowledge and skill is required to understand the complexity of an energy system like the human body.

In defining anxiety, physiological arousal plays a central role. Because of this, assessing physiological activity at first glance seems to provide an easy channel of measurement. Unfortunately this is not the case. An extensive knowledge is necessary of the specific anatomical or physiological components to be measured as well as the characteristics of the assessment apparatus for each particular measure, and the statistical properties of data obtained by such measures. Psychophysiological measurements are often peripheral and therefore are especially vulnerable to artifacts that may reduce the validity of the data.

The notion of a continuum of arousal (Duffy, 1963) was taken by many theorists to mean that any psychophysiological variable was interchangeable with another. In general, under high degrees of stress all sympathetically innovated physiological systems show the effects of increased arousal. Thus with extreme reactions nearly all of the psychophysiological measures provide an adequate indication of anxiety elicitation. However under less extreme degrees of arousal fewer systems are likely to be involved and each system may come into play in a different order for different people (Hassett, 1978). Consequently, correlations between psychophysiological measures in any study have tended to be low. In addition, each individual is influenced not only by emotional arousal but by physical activity, drugs, temperature, diet, size and many other factors. Each individual shows a "relative response stereotyping" in their patterns of psychophysiological response over a broad range of eliciting stimuli.

The present study is concerned with gender as an independent variable and consequently the influence of sex of subject on psychophysiological reactivity must be covered. The literature on sex differences in psychophysiological measures is unusually scarce. However, there has been increasing attention paid to gender, both as a source of variance in psychophysiological reactivity and to the precise nature of the underlying determinants of this variance (Venables and Christie, 1973). The present study involves the use of skin conductance, respiration and peripheral skin temperature.

Electrodermal activity

During the past fifteen years, a number of researchers have drawn attention to gender differences in electrodermal activity. It appears that not only do males and females differ on basic physiological mechanisms with regard to electrodermal activity, but that they also differ in reactivity to specific situations.

Juniper and Dykman (1967) reported sweat gland counts to be higher in women than in men. Rein (1926) demonstrated that female skin tends to depolarise faster than male skin in response to continuous high current and that its polarisation capacity is weaker. Edenberg (1972) states that males and females show opposite shifts in skin potential associated with changes in level of arousal.

Shmavonian, Miller and Cohen (1968) compared the electrodermal responses of four groups, young males, young females, aged males and aged females. These groups were run in a discrimination conditioning paradigm with a variety of autonomic and control measures. Using electrodermal responses the findings indicated that young males showed the best discrimination conditioning followed by young females, than aged femalesand aged males. The authors speculate that it may be that androgen exposed central nervous systems respond with better differentiation.

Kopaz and Smith (1971) investigated the effects of three levels of shock threat on the skin conductance of thirty male and thirty female subjects and reported significant main and interaction effects for electrodermal levels and responses. They suggested that a behaviourally relevant physiological sex difference of major significance could be the more potent activating effect of oestrogen as compared with androgen.

Epstien, Bovelreau and King (1975) investigated the magnitude of the heart rate and electrodermal responses as a function of stimulus input, motor output and their interaction. They examined reactivity to a loud noise and a strong squeeze presented separately and together. They noted that females were responsible for the greater reaction to the combined stimulus than to the squeeze alone. Males, who exhibited greater involvement than females, did not react to the noise and squeeze more than to the squeeze alone.

In summary, it would appear that males and females do differ quite significantly in electrodermal reactivity to different situations.

Skin Temperature

The temperature of the skin is largely a function of peripheral circulation. Vasoconstriction, a decrease in the diameter of peripheral arteries caused by sympathetic nervous system activation, lowers skin temperature. Vasodilation, an increase in the diameter of peripheral arteries caused by sympathetic relaxation, raises skin temperature.

In general, women do have colder hands and feet than men (Hassett, 1978). Some researchers have speculated in evolutionary terms that the poorer peripheral circulation of females is necessary to ensure a more stable blood flow to the internal organs during pregnancy. Other researchers have stated that they do not have an explanation as to why this should be true, if indeed it is (Hassett, 1978).

Schwartz and Logue (1977) carried out some work on facial thermography. They discovered a striking sex difference, with women having colder noses and cheeks, relative to the rest of their faces, than men. Across all subjects there was evidence that the mouth area was warmer during "happy thoughts" than during "sad thoughts". However, since thermography is sensitive to blood flow in relatively deep muscle structures as well as more superficial blood flow, this finding may be related to the same research group's findings on facial musculature changes in the emotions.

An interaction between temperature and the skin resistance response has been noted. Floyd and Keele (1936) reported that with a temperature of 15°C at the active skin site, skin resistance response showed a longer latent period, slower change, and a much more prolonged return to normal than occurred at 30°C.

Maulsby and Edelberg (1960) systematically varied temperature over the range 10°-45°C and expressed skin resistance level and skin resistance response as a ratio of the value at the experimental site to that at the control site. When skin temperature was increased, skin resistance response latency increased to as much as four seconds at 10°C compared to 1.5 seconds at 30°C. These effects on latency and amplitude varied with time, and the authors suggest that they represent alterations of conductance across the membrane in the skin and possibly a secondary change in the activity of sympathetic nerve endings.

Venables and Martin (1967) state that in order to obtain comparable results between subjects with regard to electrodermal activity, it is advisable to monitor skin temperature and to take steps by local or room heating to attempt to maintain a uniform skin temperature over subjects.

Respiration

Liberson and Liberson (1975) investigated sex differences in blood pressure and respiration to electric shock. Eighteen males and eighteen females were given a rest period of fifteen minutes, submitted to one minute of painful electric stimulation, then given a second fifteen minute rest period. Men were found to respond to shock with significant change in systolic blood pressure while women responded with significant respiratory changes.

No other studies on gender differences involving respiratory patterns appear to have been published.

Summary:

Over the psychophysiological measures reviewed it appears that there are distinctive gender differences. These differences are apparent both in the intensity of responding to eliciting stimuli and also in the systems that are likely to become involved.

Bell (1971) reviewed past volumes of the Journal of Experimental Psychology and Psychophysiology noting the number of studies controlling for sex and those failing to state sex (Table 1).

TABLE 1: Sex of subjects as reported in two psychological journals.

Subject Information	1 %	2 %
No sex stated	14.3	3.6
Male and female	24.2	71.1
All male	54.5	19.3
All female	7.0	6.0
Experiments with control for menstrual cycle	2.6	Not given

1. Psychophysiology, 1964-1970, Vols 1-6.

2. Journal of Experimental Psychology, 1966-1967, Vols 71-75.

A more recent review of studies in Psychophysiology using electrodermal measures was carried out (Table 2).

TABLE 2: Sex of subjects in studies using electrodermal measures.

Subject Information	%
No sex stated	25.0
Male and female	28.57
All male	28.57
All female	14.28
Male and female compared	3.57

Psychophysiology 1977-1978, Vols 13-14.

In spite of the distinctive differences between the sexes, many experimenters continue to ignore the warning that

> "It would be grossly eroneous to mix men and women subjects where physiological measures are being obtained."
>
> (Shmovonian, Yarmat and Cohen, 1965)

Those experimenters who do not mix the sex of their subjects still seem to use the somewhat simpler male (Venables and Christie, 1973). This preference for males is also apparent in the studies reviewed on relaxation using psychophysiological measures.

2.5 SUMMARY

It is difficult to summarise the available conflicting results concerning brief relaxation training. Why the use of similar methodologies as in the case of the studies of Grossberg (1965) and Paul (1969) should produce such contradictory results is not clear. Sex differences in psychophysiological reactivity is an important variable to be considered in any experiment using these measures. However, it is a variable which has been neglected, and this neglect may have contributed to the ambiguity noted by Mathews (1971). The literature of therapist-subject sex differences is somewhat less clear although there is some evidence that this is a significant variable.

The purpose of this investigation was to determine whether differences exist between males and females in psychophysiological reactivity to audio-taped relaxation instructions. It was predicted that there would be systematic changes over time during relaxation training in at least one psychophysiological measure for each subject. The assumption was held that one or more of the sex of therapist - sex of subject groups might show greater changes than other groups, but there was insufficient information available from previous research to predict which group(s) would show the greatest changes.

CHAPTER 3

METHOD

3.1 SUBJECTS

The subjects were thirty two undergraduate students at the University of Canterbury, sixteen females and sixteen males. Four treatment groups were used in order to balance for therapist - subject sex differences with eight subjects in each group.

		Sex of Subject	
		Male	Female
voice on tape	male	n = 8	n = 8
	female	n = 8	n = 8
	Total	n = 16	n = 16

The average age of the subjects was twenty with a range from seventeen to twenty five. The subjects reported that they were not receiving medication, nor had any sleep disturbances. They were asked about their belief in the ability to be taught to relax. On a scale of 1-7, 1 meaning not at all and 7 meaning implicitly believing that they could be taught to relax, the majority answered 5 or 6 with a range from 3-7.

3.2 APPARATUS

Psychophysiological Receiving Equipment

All the psychophysiological measures employed Lafayette instruments. The recording was done on a Four Channel

Polygraph (Lafayette model 76102) set at a paper speed of 2.5 mm/second.

Respiration: The magnitude of thoracic expansion was recorded by a pneumograph (model 76501). This was amplified by a Multiplex GSR Amplifier (model 76405) in the auxiliary mode.

Skin Conductance: Skin conductance was measured using a skin conductance amplifier (model 76441 removed from a model 76100-30 Barabasz Desensitization Quantifier). Beckman silver/silver chloride hat electrodes were used with Beckman electrode gel. They were attached to the volar surface of the distal phalanx of the second and third digits of the right hand using double sided adhesive washers (Barabasz, 1977).

Pulse Rate and Volume: A photoelective plethsmograph (model 76604) was used to measure peripheral pulse volume. This was attached to the subject's first digit on the right hand using a spring loaded finger clip. This was amplified in the auxiliary mode by a conductance amplifier (model 76441).

Temperature: Skin temperature was measured (in degrees Farenheit) by a Yellow Springs 700 series surface temperature probe attached to the fourth digit of the left hand. This was amplified by the Temperature Amplifier (model 76440).

Experimental Room

The experimental room had a constant level of illumination. Unfortunately, because of the lack of air conditioning, it was impossible to keep the humidity and air temperature in the room constant. The experimental room contained a Lazyboy Recliner

Rocker and the experimental equipment outlined above. The experimenter stayed in the room throughout the entire experiment.

Relaxation Instructions

Two tapes were made, one using a female voice other than the experimenter and one using a male voice. The tapes were made in a soundproofed room by two postgraduate clinical students at the University of Canterbury. The two students had equal experience. Lazarus' (1971) General Relaxation Instructions were used with a modification at the end of the instructions. The instruction to "switch off the recorder and just go back and relax on your own" was eliminated. The length of the tapes was 10 minutes and 30 seconds (see Appendix).

3.3 PROCEDURE

The experiment was carried out by a female experimenter The subjects were seated in the Recliner chair. They were told that they were participating in an experiment which was measuring sex differences in psychophysiological measures to relaxation instructions. No mention was made of the fact that the instructions differed. They were then connected to the psychophysiological recording equipment with a brief explanation of each measure. The procedure for the connection was standardised in the same order each time. The subject was then asked not to move his/her hand so as to minimise movement artifacts in recording. Tonic levels of reactivity were established during a five minute period in which the subject was asked to sit quietly.

The startle response necessary for scoring skin conductance was then obtained. The subject was asked to blow up a balloon until it burst and the maximum deflection of the pen was used (Lykken, 1966). Once tonic levels of reactivity were restored, approximately 5 minutes, the tape was played. At the end of the tapes the subjects were instructed to sit quietly while the final measurements were taken. They were then disconnected from the psychophysiological equipment.

3.4 SCORING

Time Sampling

The psychophysiological measures were sampled for thirty second intervals every two minutes giving 6 samples for each measure.

Data Reduction

(1) Respiration rate - The number of peaks during a 25 second interval were counted. Only five measures were available because the first sample coincided with a taped instruction to take a deep breath.

(2) Skin conductance - The maximum deflection in each of the six time samples was scored. This was expressed in terms of a proportion of the individual's maximum deflection (usually the startle stimulus of blowing up a balloon until bursting), according to standardised procedure (Lykken and Venables, 1971). SCR maximum was then divided into each reaction period sampled.

(3) Peripheral skin temperature was recorded at the beginning of each thirty second sample.

(4) Peripheral pulse volume was not scored because of the low level of reactivity over all time samples of most of the subjects to this particular measure.

CHAPTER 4

RESULTS

4.1 DESIGN

The design used was a three-way design with repeated measures on the third factor. The factors were:

1. Therapist (E) 1 = male, 2 = female
2. Subject (S) 1 = male, 2 = female
3. Time (T) 1 = first time period, 2 = second time period . . . 6 = sixth time period.

The four dependent variables were

1. Uncorrected skin conductance
2. Corrected skin conductance
3. Rate of respiration
4. Peripheral skin temperature.

4.2 ANALYSIS

In order to test the hypothesis that psychophysiological reactivity during relaxation training will be different in males than in females and to explore differences between groups over time, a Multivariate Analysis of Variance (MANOVA) was used to check for significant main and interaction effects. None of the MANOVA interaction effects were significant at the .05 level; consequently only the three main effects were tabulated. The significance of the multivariate effects were assessed using

Wilk's Lambda. The homogeneity of the variance for the corrected skin conductance across the male and female subject groups was also analysed.

Changes in psychophysiological reactivity over time:

The results of the MANOVA analysis for the changes in psychophysiological reactivity over time to the relaxation training tapes are summarised in Table 3. The effects and non-effects of each of the dependent variables are illustrated in Figures 1-4.

TABLE 3: Summary of the MANOVA results for time effect.

	F	P	Correlation with the discriminant function
Multivariate F-test (Wilk's Lambda)	4.200	0.001	
Univariate F-test, $F_{(5, 166)}$			
Uncorrected skin conductance	3.763	0.003	0.456
Range corrected skin conductance	15.139	0.001	0.970
Respiration	2.654	0.025	0.195
Skin temperature	0.042	0.999	-0.006

FIGURE 1: Means of uncorrected skin conductance as a function of time for the therapist (T)-subject (S) groups

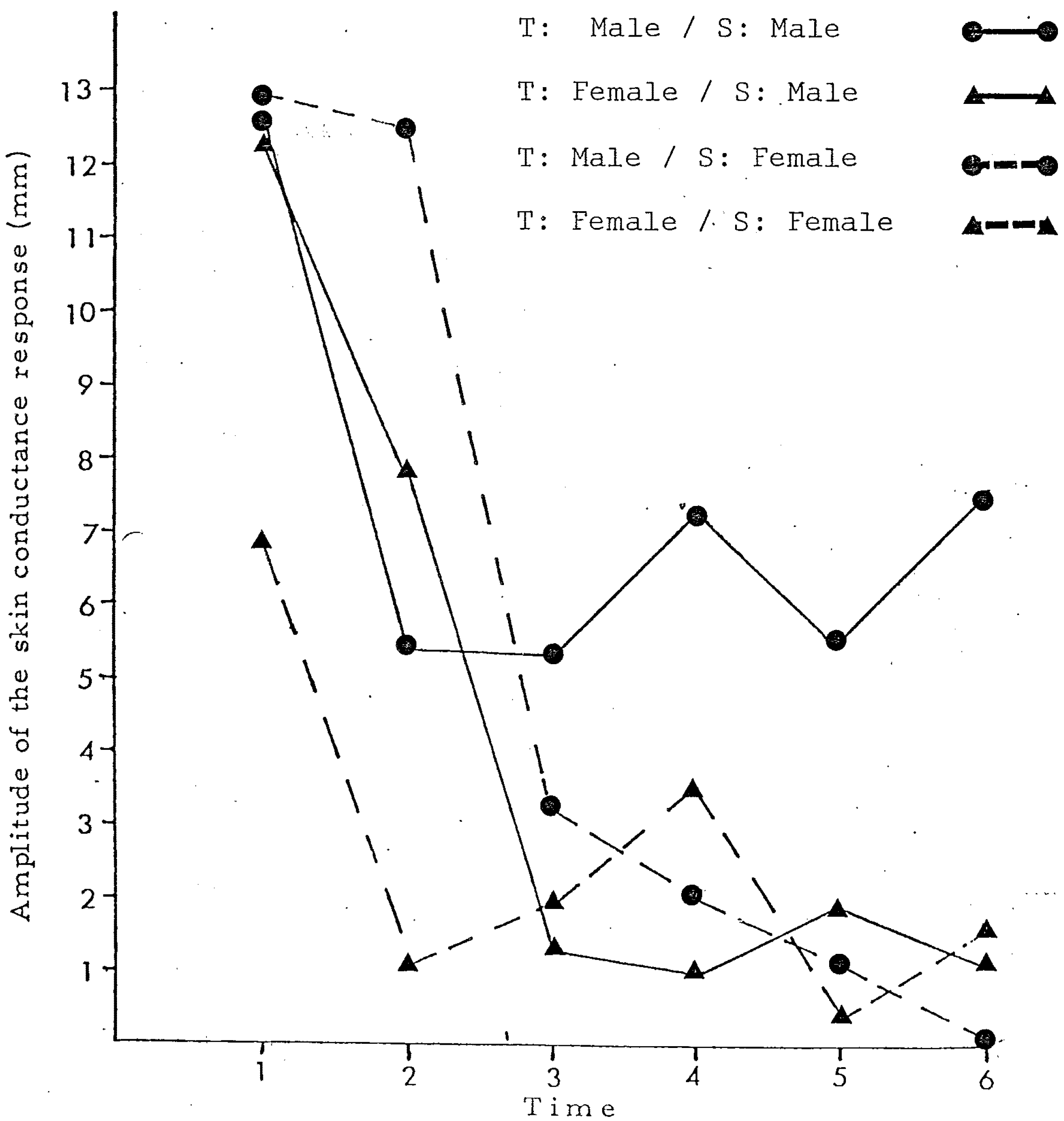


FIGURE 2: Means of range corrected skin conductance as a function of time for the therapist (T) - subject (S) groups

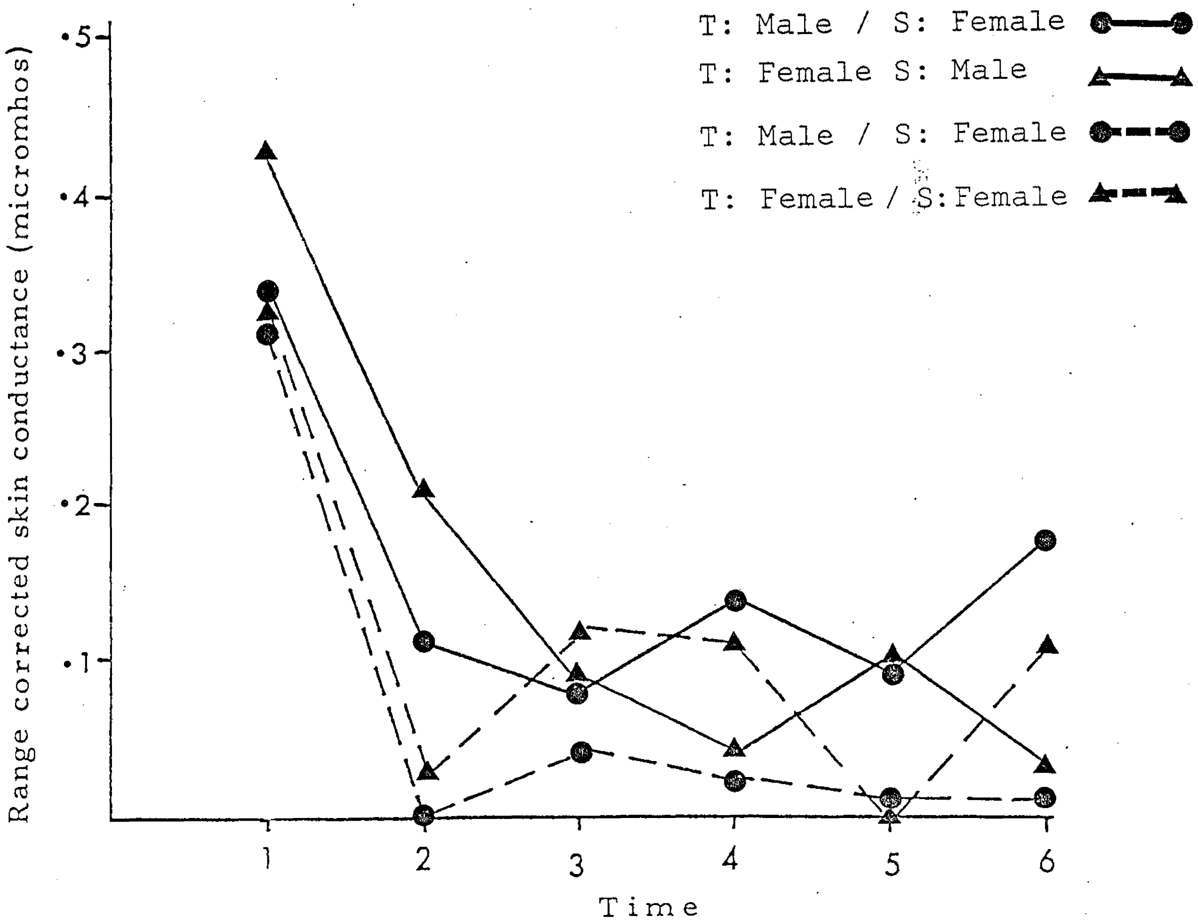


FIGURE 3: Means of the respiration rate as a function of time for the therapist (T)-subject (S) groups.

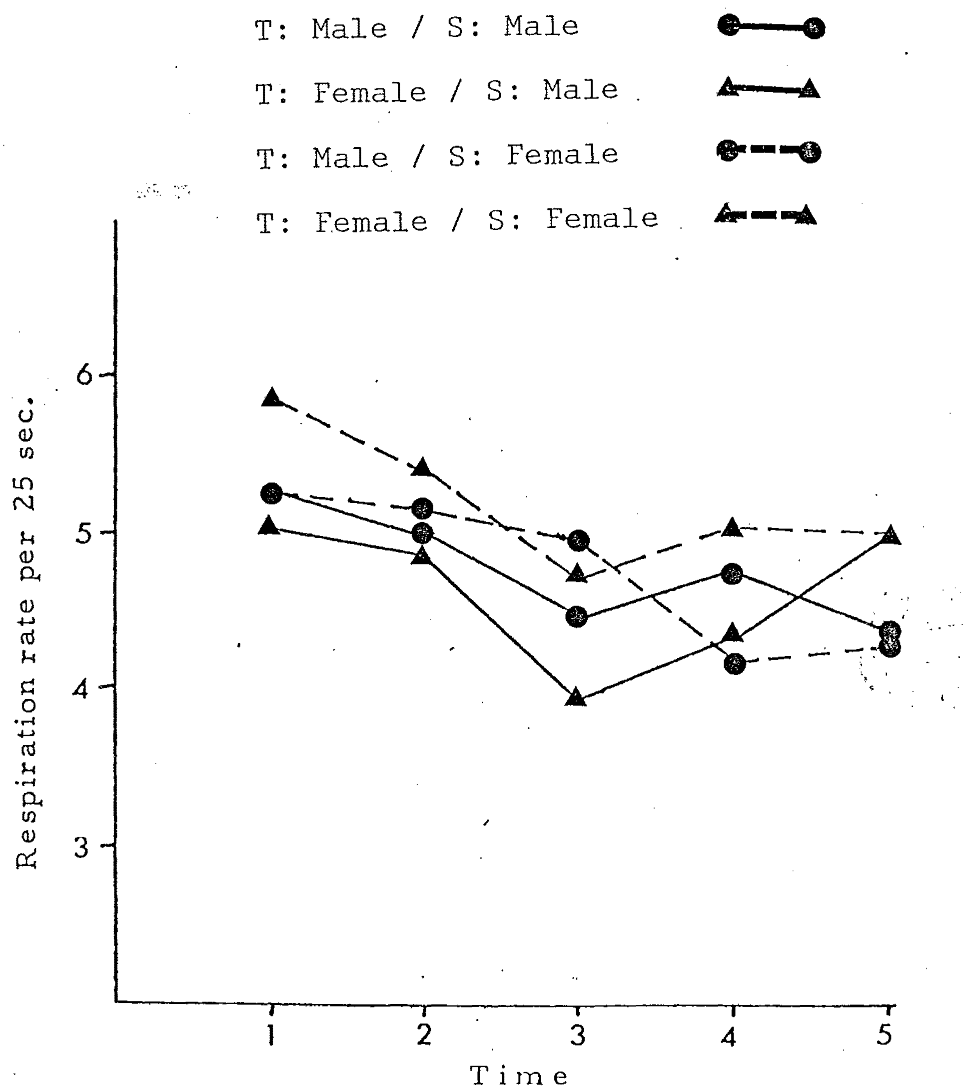
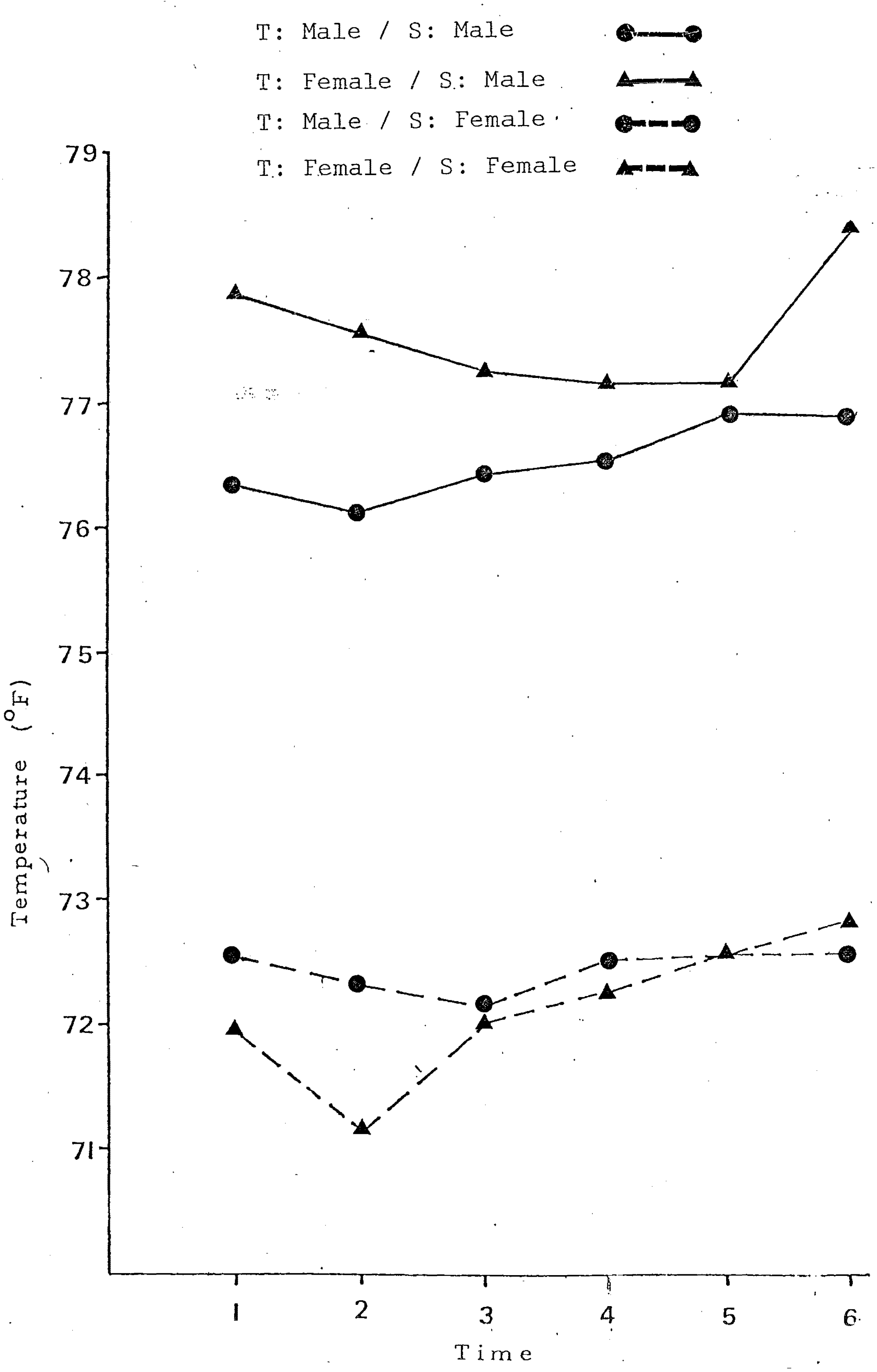


FIGURE 4: Means of peripheral skin temperature as a function of time for the therapist (T)-Subject (S) groups



As can be seen from Table 3, there was a significant decrease in psychophysiological reactivity over time ($p<0.001$). However not all the dependent variables showed this decrease over time.

The square of the correlation with the discriminant function (see the last column in Table 4) gives an estimate of the proportion of the discriminating effect explained by each of the variables. Thus corrected skin conductance explained 94% of the effect while uncorrected skin conductance and respiration explained 20% and 3% respectively and peripheral skin temperature had a negligible effect.

Although skin temperature (Figure 4) showed no significant changes over time, individual subjects showed different responses over time. The peripheral skin temperature increased in some subjects, stayed stable in others, and decreased in others. This variability appeared to be constant over groups, thus giving no significant changes over time between groups.

There were no significant MANOVA interaction effects between sex of subjects over time ($p< 0.980$) nor between sex of voice on the tapes over time ($p < 0.998$).

<u>Therapist-subject sex differences.</u>

The results of the MANOVA analysis for the effect of the sex of the voice on the tape are summarised in Table 4.

TABLE 4: Summary of MANOVA results for therapist effect.

	F	P
Multivariate F-test (Wilk's Lambda)	2.937	0.022
Univariate F-test F (1, 166)		
Uncorrected skin conductance	4.369	0.038
Range corrected skin conductance	0.195	0.660
Respiration	2.598	0.109
Skin temperature	0.150	0.699

Table 4 indicates a significant MANOVA effect for the sex differences in voice on the tapes. However it indicates that this factor is significant only for the uncorrected skin conductance. As this measure is not corrected for individual differences it is not possible to compare groups using this measure. Therefore this is not a significant effect but is an artifact due to baseline differences. There are no significant differences on any of the other psychophysiological measures.

There was also no significant interaction effect between sex of the voice on the tape and sex of the subject ($p < 0.556$). Consequently the sex of the voice on the tape had no significant effect on the subjects' psychophysiological reactivity on the measures obtained.

Gender differences in psychophysiological reactivity

The results of the MANOVA analysis for gender differences in psychophysiological reactivity are given in Table 5. Figures 5-7 illustrate the combined male subject and combined female subject data.

TABLE 5: Summary of the MANOVA results for the subject effect.

	F	P	Correlation with the discriminant function
Multivariate F-test (Wilk's Lambda)	8.804	0.001	
Univariate F-test, F (1, 166)			
Uncorrected skin conductance	1.312	0.254	0.191
Range corrected skin conductance	7.014	0.009	0.442
Respiration	3.886	0.050	-0.329
Skin temperature	26.833	0.001	0.865

FIGURE 5: Means of peripheral skin temperature as a function of time for male and female subject groups.

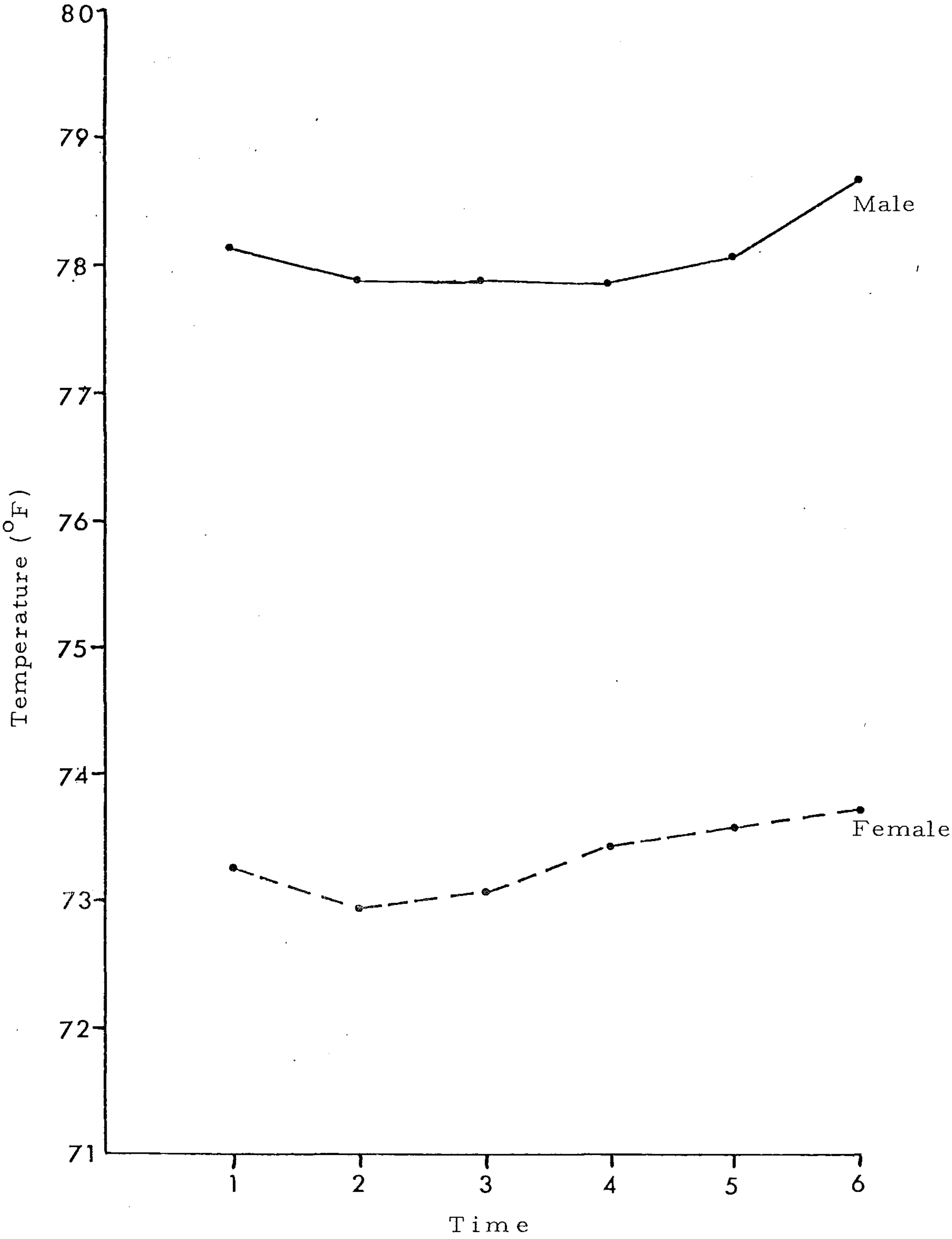


FIGURE 6: Means of the respiration rate as a function of time for the male and female subject groups.

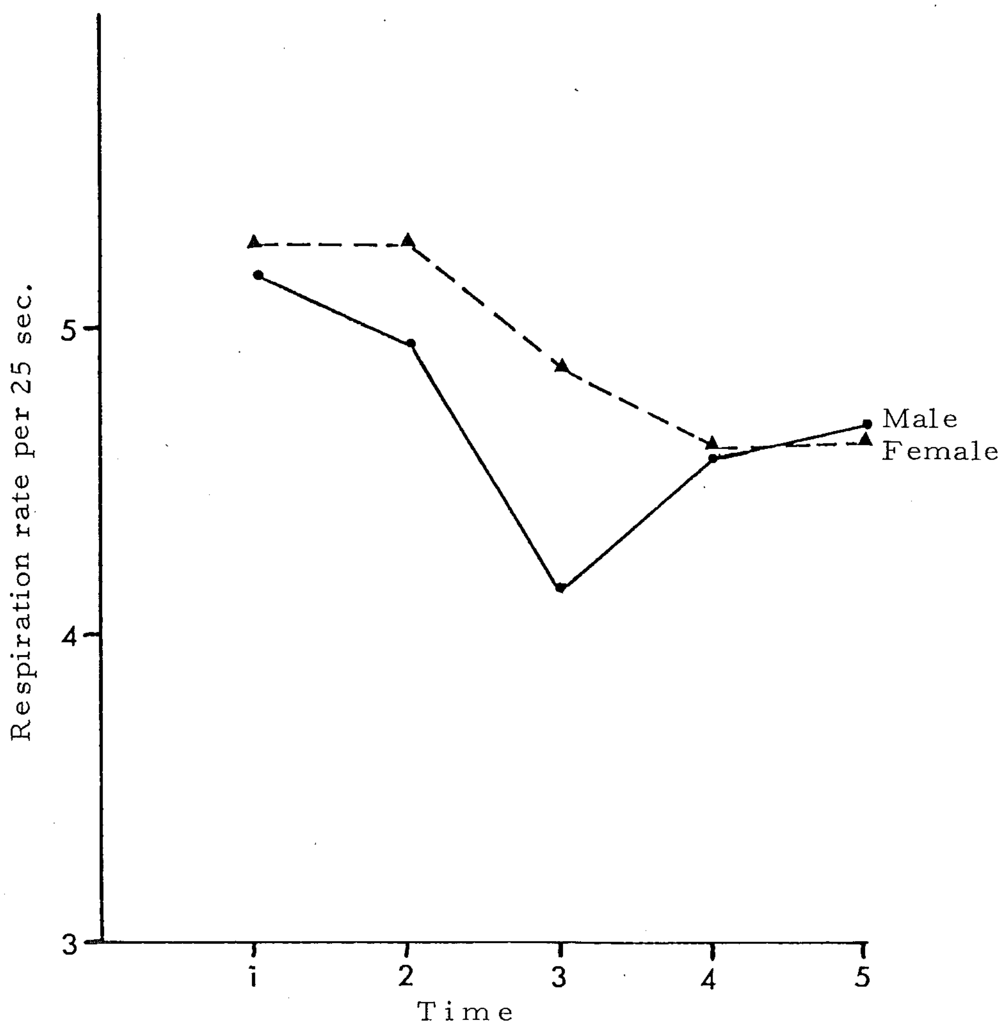


FIGURE 7: Means of range corrected skin conductance as a function of time for male and female groups.

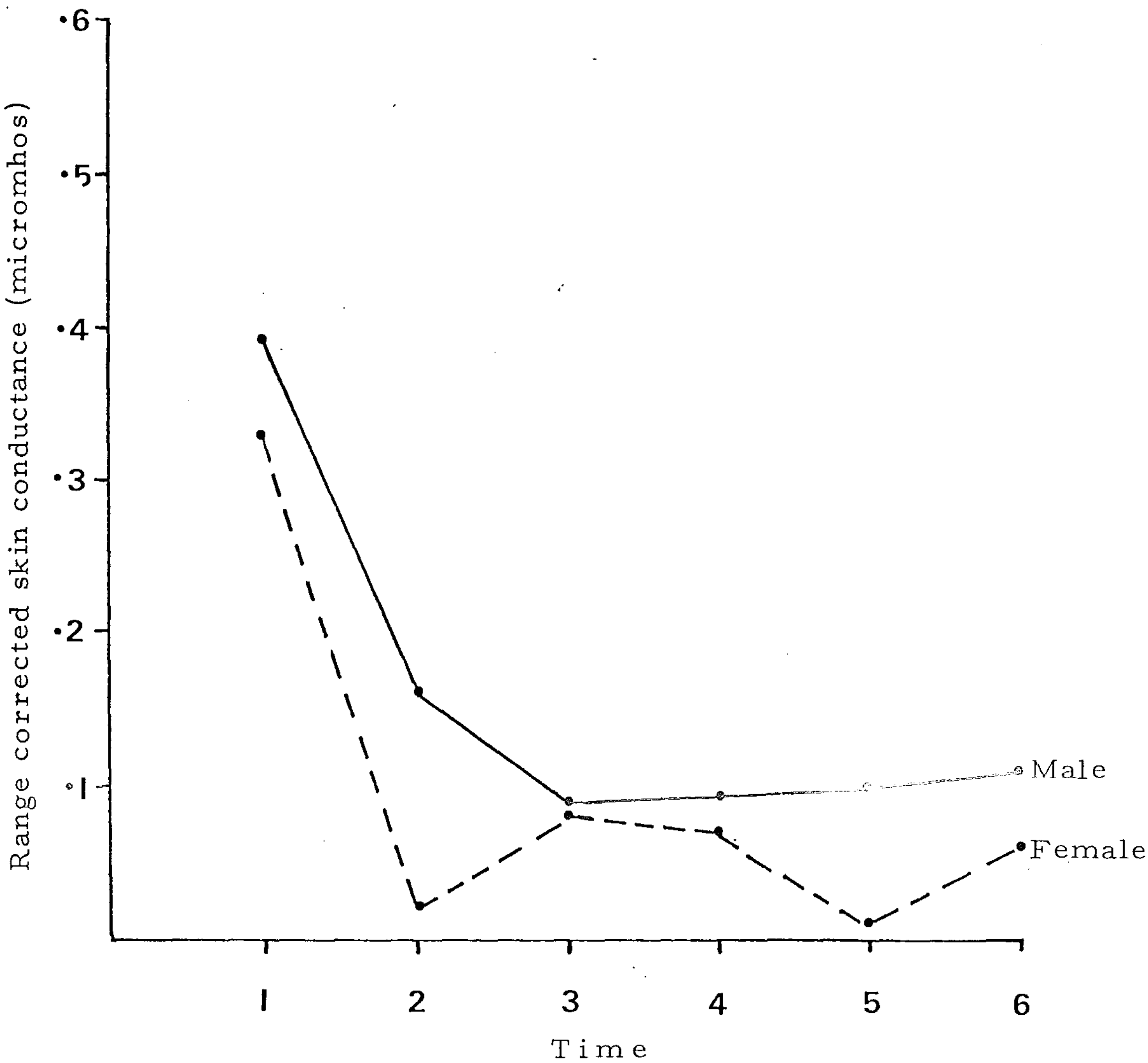


Table 5 indicates a significant MANOVA effect due to the sex of the subject which is significant ($p < .05$) for corrected skin conductance respiration and temperature.

As there were no differences in reactivity between the sex of the voice on the tape and sex of the subjects, the data were collapsed over the two groups for the significant measures and are illustrated (Figures 5-7) for combined female and male data.

The proportions of the discrimination effect explained by each of the variables were respectively 74% for skin temperature, 19% for skin conductance and 10% for respiration.

Both the male and female groups showed no significant change in peripheral skin temperature over time; however there were significant differences in skin temperature between males and females (Figure 5). On average males had a peripheral skin temperature of 2.512^{o}F higher than females ($p < .001$).

Figure 6 shows that males had a lower respiration rate than females ($p < .05$). Females had significantly lower skin conductance ($p < .009$) as shown by Figure 7.

Homogeneity of the variance for skin conductance.

Males appear to have much higher standard deviations over the six time points for the skin conductance measures than females (Figure 8). These apparent differences were tested for significance using an F-ratio (the largest standard deviation over the smallest standard deviation) as outlined by Guilford (1965, p. 191).

Table 6 gives the F ratios for the differences in standard deviations of each time point.

FIGURE 8: Standard deviations of the range corrected skin conductance for the male and female subject groups.

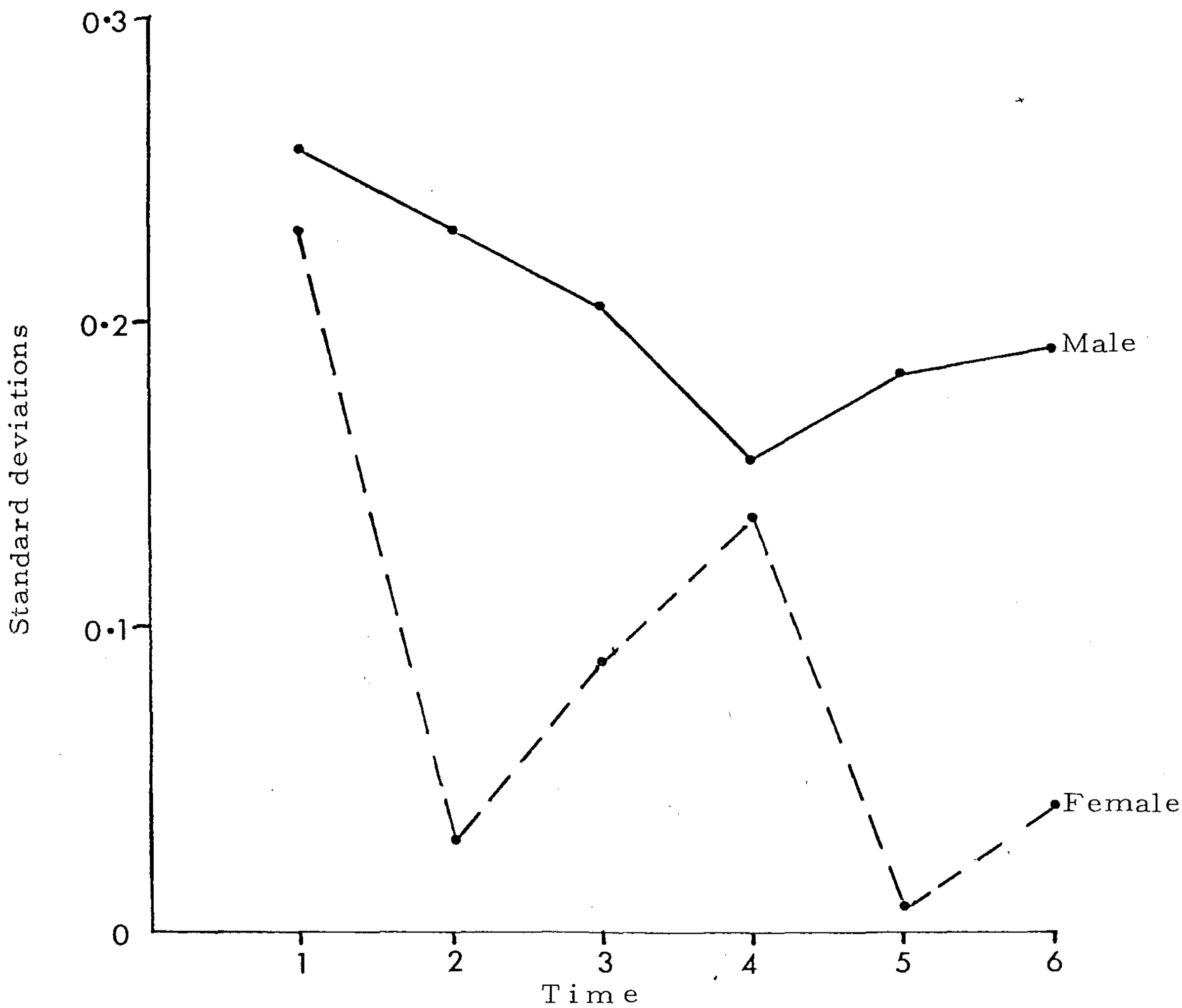


TABLE 6: Equality of variance for skin conductance.

Time	Male SD	Female SD	F ratio for the variance difference
1	.2584	.2384	1.084
2	.2398	.0322	7.447[a]
3	.1831	.0947	1.933
4	.1567	.1381	1.135
5	.1897	.0075	25.293[a]
6	.1918	.0844	2.273

$F_5\ (7,\ 7) = 3.75.$

[a] indicates p 0.05.

Two of the six time points show a significant difference for the variance ($p < 0.05$) and there appears to be a trend for females to have a lower variance on skin conductance measures.

CHAPTER 5

DISCUSSION AND SUMMARY

Psychophysiological responses of thirty-two subjects, sixteen male and sixteen female, were monitored during two relaxation tapes. One tape was made in a female voice and the other a male voice. Four subject groups were used to balance for therpist-subject sex differences. The psychophysiological responses monitored were skin conductance, peripheral skin temperature and respiration. The purpose of the investigation was to determine whether or not differences exist between males and females in psychophysiological reactivity to audio-taped relaxation instructions. The study also sought to determine whether or not subjects responds to audio-taped relaxation instructions are significantly effected by sex of person making the recording.

Subjects' psychophysiological responses were compared over time for the female voice tape and the male voice tape. Male and female subjects' psychophysiological responses were also compared.

5.1 PSYCHOPHYSIOLOGICAL REACTIVITY TO THE RELAXATION INSTRUCTIONS.

The results showed significant decreases in psychophysiological reactivity over time in relaxation training. The subjects showed significant decreases in skin conductance and respiration. No significant variations were found in peripheral skin temperature over time.

The lack of changes over time for peripheral skin temperature is contrary to what was expected from the literature. (Hassett, 1978). With relaxation of the sympathetic nervous system, vasodilation should occur with a corresponding increase in skin temperature. Unfortunately, the results of this study were confounded by the lack of controlled air temperature in the experimental room.

This study investigated differences between male and female subjects rather than the effectiveness of relaxation. It is not possible to attribute these decreases to the brief relaxation training instructions alone. However as tonic levels had been established before the commencement of the tapes by sitting quietly it is possible that this lowering in skin conductance and respiration is more than can be expected from subjects sitting quietly.

5.2 THE EFFECT OF THERAPIST-SUBJECT SEX DIFFERENCES ON PSYCHOPHYSIOLOGICAL REACTIVITY.

The results showed no significant differences between groups receiving instructions from a tape made using a male voice and one using a female voice.

Although the female experimenter was present throughout the experiment, the explanations and instructions prior to the exposure to the relaxation training were standardised. Data was only recorded during the playing of the tape. Both tapes were obviously not in the same voice as the experimenter.

As this appears to be the first investigation of sex of therapist differences using psychophysiological measures as dependent variables, it is not possible to compare this study with other studies (Robinson and Suinn, 1969; Cotler, 1971) using self-rating measures. No subjective measures were obtained of the subjects' satisfaction with the relaxation instructions. However, on the basis of this study it appears that sex of the subject does not effect psychophysiological reactivity. This is in agreement with Cotler's (1971) study on automated desensitization which concluded that patients need not be included or excluded for automated therapy on the basis of sex differences between themselves and the therapist.

5.3 SEX DIFFERENCES IN PSYCHOPHYSIOLOGICAL REACTIVITY.

Male and female subjects showed similar psychophysiological reactivity over time. Striking differences between their responses were, however, apparent.

The most dramatic difference was in peripheral skin temperature. The results of this study support Hassett's (1978) observation that, in general, women have colder hands than men. Female subjects were found to have a peripheral skin temperature that was on average 2.5^{o}F lower than male subjects ($p < 0.001$).

Skin conductance in female subjects was lower than in male subjects. Female subjects showed lower conductance levels over all time samples. Robinson and Suinn (1969) suggested that the significant sex differences found on a self-rating measure may be because females were more able to relax. The results of this study do not support this suggestion.

An interesting question arises when the differences between male and female subjects in peripheral skin temperature and skin conductance are noted. Maudsby and Edelberg (1960) reported decreases in skin conductance latencies and increases in rise times and amplitude with increased temperatures at the site of the recording. Perhaps some of the differences in electrodermal activity between male and female subjects could be accounted for by differences in peripheral skin temperature. If the lower skin conductance rates are a function of the peripheral skin temperature a controlled room temperature is not going to minimize the discrepancy between male and female subjects.

Skin conductance of male subjects tended to show higher standard deviations than female subjects. This was only significant at two of the time points. Male subjects appear to be more variable in their skin conductance responses.

Previous studies on the effectiveness of relaxation training using psychophysiological measures have produced contradictory results (Mathews, 1971). These contradictions may be related to the sex of the subjects used. Paul (1969) produced evidence that the relaxation instructions had a specific effect independent of the general effects of adaptation and the reduction of external stimuli. Paul's (1969) study appears to be the only one which used only females as experimental subjects. In the light of this study in which females showed lower skin conductance rates and have more homogeneity in responding to relaxation tapes, it may be that this is an important factor contributing to these significant results.

5.4 SUMMARY

The results of this study support Shmavonian, Yarmet and Cohen's (1965) warning that:

> "It would be grossly eroneous to mix men and women subjects where physiological measures are being obtained."

The results indicated that both male and female subjects showed similar psychophysiological responses to relaxation tapes over time. However, this study showed significant differences between male and female subjects' psychophiological responses. This casts doubt on previous research combining male and female subjects.

Sex differences in psychophysiological reactivity is a factor which requires more research before any firm conclusions are drawn. However, it is a variable which should be considered by investigators using psychophysiological measures in their research.

APPENDIX

GENERAL RELAXATION INSTRUCTIONS
(Lazarus, 1971)

Begin by getting as comfortable as you can. Settle back comfortably. Just try to let go of all the tension in your body. Now take in a deep breath. Breathe right in and hold it (five-second pause). And now exhale. Just let the air out quite automatically and feel a calmer feeling beginning to develop. Now just carry on breathing normally and just concentrate on feeling heavy all over in a pleasant way. Study you own body heaviness. This should give you a calm and reassuring feeling all over (ten-second pause). Now let us work on tension and relaxation contrasts. Try to tense every muscle in your body. Every muscle: your jaws, tighten your eyes, your shoulder muscles, your arms, chest, back, stomach, legs, every part just tensing and tensing. Feel the tension all over your body - tighter and tighter - tensing everywhere, and no let it go, just stop tensing and relax. Try to feel this wave of calm that comes over you as you stop tensing like that. A definite wave of calm (ten-second pause).

Now I want you to notice the contrast between the slight tensions that are there when your eyes are open and the disappearance of these surface tensions as you close your eyes. So while relaxing the rest of your body just open your eyes and feel the surface tensions which will disappear when you close your eyes. Now close your eyes and feel the greater degree of relaxation with your eyes closed (ten-second pause) all right, let us get back to the breathing. Keep your eyes closed and take in a deep, deep breath and hold it. Now relax the rest of your body as well as you can and notice the tension from holding your breath. Study the tension. Now let out your breath and feel the deepening relaxation - just go with it beautifully relaxing now. Breathe normally and just feel the relaxation flowing into your forehead and scalp. Think of each part as I call it out - just relaxing - just letting go, easing up, eyes and nose, facial muscles. You might feel a tingling sensation as the relaxation flows in. You might have a warm sensation. Whatever you feel I want you to notice it and enjoy it to the full as the relaxation now spreads very beautifully into the face, into the lips, jaws, tongue, and mouth so that your lips are slightly parted as the jaw muscles relax further and further. The throat and neck relaxing (five-second pause), shoulders and upper back relaxing, further and further, feel the relaxation flowing into your arms and to the very tips of your fingers (five-second pause). Feel the relaxation in your chest as you breathe regularly and easily. The relaxation spreads even under your armpits and down your sides, right into the stomach area. The relaxation becomes more and more obvious as you do nothing but just give way to the pleasant serene emotions which fill you as you let go more and more. Feel the relaxation - stomach and lower back all the way through in a warm, penetrating, wavy, calm and down your hips, buttocks, and thighs to the very, very tips of your toes. The waves of relaxation just travel down your calves to your ankles and toes. Feel relaxed from head to toe. Each time you practice this you should find a deeper level of relaxation being achieved - a deeper serenity and calm, a good calm feeling.

Now to increase the feelings of relaxation at this point what I want you to do is just keep on relaxing and each time you exhale, each time you breath out for the next minute, I want you to think the word relax to yourself. Just think the word relax as you breathe out. Now just do that for the next minute (one-minute pause). Okay, just feel that deeper relaxation and carry on relaxing. You should feel a deeper, deeper feeling of relaxation. To even further increase the benefits, I want you to feel the emotional calm, those tranquil and serene feelings which tend to cover you all over inside and out, a feeling of safe security, a calm indifference - these are the feelings which relaxation will enable you to capture more and more effectively each time you practice a relaxation sequence. Relaxation will let you arrive at feeling a quiet inner confidence - a good feeling about yourself (five-second pause). Now once more feel the heavy sensations that accompany relaxation as your muscles switch off so that you feel in good contact with your environment, nicely together, the heavy good feeling of feeling yourself calm and secure and very, very tranquil and serene.

Now we can deepen the relaxation still further by just using some very special stimulus words. Let's use the words calm and serene. What I would like you to do is to think these words to yourself twenty times or so. Don't bother to count. Approximately twenty or thirty times just say to yourself calm and serene and then feel the deepening - ever, ever deepening - waves of relaxation as you feel so much more calm and serene. Now you just do that; take your time, think of the words and feel the sensations over and over (pause of about one minute). Good.

Now I am going to count backward from 10 to 1. At the count of 5 I would like you to open your eyes, and then by the time I reach 1, just kind of stretch and yawn. Okay, now counting backward: 10, 9, 8, 7, 6, 5, open your eyes 4, 3, 2, and 1.

Note: For further reference consult A. Lazarus, "Daily Living: Coping with Tensions and Anxieties" (a series of cassette recordings incorporating three relaxation instructions), Chicago, Ill: Instructional Dynamics Incorporated.

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